

Claims

1. Membrane electrode unit for membrane fuel cells,
comprising an ion-conducting membrane, at least
one anode electrode layer, at least one cathode
electrode layer, at least one porous, water
repellent gas diffusion layer mounted on the anode
side and at least one porous, water repellent gas
diffusion layer mounted on the cathode side,
wherein
- the total pore volume of the cathode gas
diffusion layer is higher than the total pore
volume of the anode gas diffusion layer ($V_{\text{Cathode}} > V_{\text{Anode}}$), and
- the amount of water repellent agent in the
anode and the cathode gas diffusion layer is in
the range of 20 to 35% by weight (based on the
total weight of the gas diffusion layer), and
- the amount of water repellent agent in the
anode gas diffusion layer is identical or higher
than the amount of water repellent agent in the
cathode gas diffusion layer ($\text{WRA}_{\text{Anode}} \geq \text{WRA}_{\text{Kathode}}$).
2. Membrane electrode unit according to Claim 1,
wherein the the total pore volume of the gas
diffusion layer on the cathode side (V_{Cathode}) is in
the range from 1.0 to 2.5 ml/g and the total pore
volume of the gas diffusion layer on the anode
side (V_{Anode}) is in the range from 0.5 to 2.0 ml/g.
3. Membrane electrode unit according to Claim 1,
wherein the water repellent agent comprises of
fluorinated polymers such as PTFE, PVDF, and FEP
and mixtures thereof.
4. Membrane electrode unit according to Claim 1,
wherein the gas diffusion layers on the anode
and/or the cathode side comprise a microlayer with

a layer thickness between 5 and 30 micron.

5. Membrane electrode unit according to Claim 1,
wherein the ion-conducting membrane consists of
5 proton-conducting polymer materials such as
tetrafluoro-ethylene/fluorovinyl ether copolymers
having acid functions, in particular sulphonic
groups.
- 10 6. Membrane electrode unit according to Claim 1,
wherein the electrode layers comprise of
catalytically active, finely divided noble metals,
such as, for example, platinum, palladium,
ruthenium, gold or combinations thereof.
- 15 7. Membrane electrode unit according to Claim 1,
furthermore comprising sealing materials and
optionally reinforcing materials for gas-tight
sealing on installation in membrane fuel cell
20 stacks.
8. Membrane fuel cell stack, comprising membrane
electrode units according to any one of Claims 1
to 6.
- 25 9. Process for operating a membrane fuel cell stack
with dry, unhumidified operating gases, wherein
the membrane fuel cell stack comprises the
membrane electrode units according to any one of
30 Claims 1 to 6.
10. Process for operating a membrane fuel cell stack
according to claim 9, wherein the dry,
unhumidified gases comprise of hydrogen, reformat
35 gas, oxygen or air.